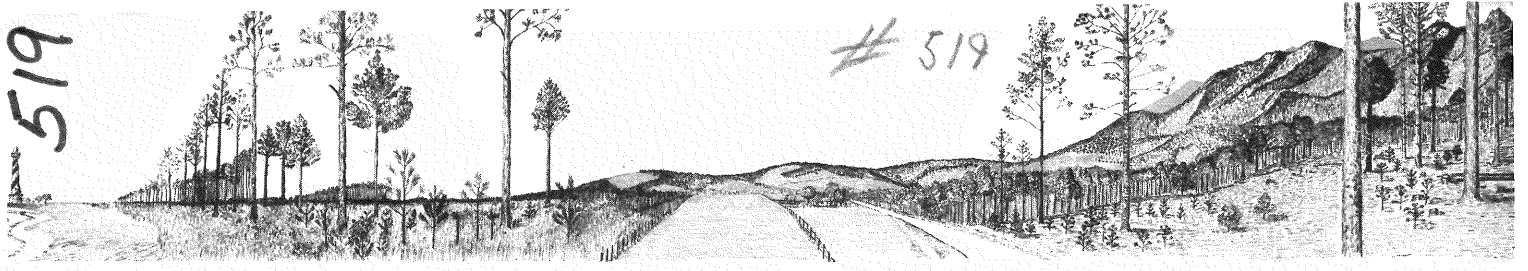

USDA Forest Service Research Note SE-207 October 1974

PALES AND PITCHEATING WEEVILS: DEVELOPMENT IN RELATION TO TIME PINES ARE CUT IN THE SOUTHEAST

Abstract.--As a simulation of oviposition in pines cut at various times, eggs of pales weevils, Hylobius pales (Herbst), or pitcheating weevils, Pachylobius picivorus (Germar), were inserted into billets of white pine, Pinus strobus L. These were buried at monthly intervals from May through August 1968 at sites in the Atlantic Coastal Plain, Georgia Piedmont, and Southern Appalachians. The time required for development from egg to adult emergence ranged from 3 to 14 months, depending on date of oviposition and location. The results indicate that harvesting of pine after June in the Piedmont and Coastal Plain or any time during the summer or fall in the Southern Appalachians will increase the chance of weevil damage to seedlings planted during the winter.

In the Southeast, the time of year in which timber is harvested greatly affects the severity of killing of pine seedlings by the pales weevil, Hylobius pales (Herbst), and the pitcheating weevil, Pachylobius picivorus (Germar). Pine seedlings are usually planted between December and March in the Southeast, and, if planted on recently cutover land, up to 90 percent may be killed by the feeding of weevils attracted to the stumps and roots for breeding. Newly emerged weevils also feed on the bark of pine seedlings before flying to freshly cut areas. When the bark is eaten from around the stem, the seedlings quickly die (Speers and Rauschenberger 1971).

Field and laboratory studies of weevils which damage pine seedlings have been made throughout the South and Southeast (Manwan[1]; Wallis[2]; Bullard and Fox 1969, 1970; Franklin and Taylor 1970; Taylor and Franklin 1970). After studies in the Piedmont near Durham, North Carolina, Beal and McClintick (1943) concluded that there was one complete and a second overlapping generation of pales weevils each year. In Texas, Thatcher (1960) excavated roots of pines cut in the four seasons of the year and established a relationship between season of cut and emergence of the pitcheating weevil. None of these studies, however, determined the field development of the weevils on the basis of known date of oviposition.

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[1]Manwan, I. The biology of the pales weevil, Hylobius pales (Herbst) in Arkansas. M.S. thesis, Univ. Ark., 74 p. 1964.

[2]Wallis, G. W. The biology of the pitch-eating weevil, Pachylobius picivorus Germ. M.S. thesis, Univ. Ark., 62 p. 1964.

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In 1968 and 1969, I sought to clarify the relationship between date of oviposition and field development of pales and pitcheating weevils in three regions of the Southeast. My investigations were prompted by a proposed ban on the insecticides used to protect pine seedlings from weevil damage. Such a ban would increase the need to coordinate harvesting and planting in order to avoid or minimize weevil damage to pine plantations.

MATERIALS AND METHODS

In preliminary rearings, I determined that pales and pitcheating weevils can be reared continuously in cut pine stems rather than in their natural habitat in tree roots and stumps. Reared weevils were of normal size, reproduced, and exhibited activity similar to that of field-collected weevils. As host material in the present study, I used white pines, Pinus strobus L., thinned from a 16-year-old plantation on the Bent Creek Experimental Forest near Asheville, North Carolina. Billets 30 cm long and 5 to 10 cm in diameter were sawn from these pine stems and used for rearing.

Eggs were secured from our laboratory colonies of each of the two species. Special care was exercised to maintain these extracted eggs under high humidity at 5° to 7° C until their transfer to the billets. In each billet, eight or nine eggs were inserted into slits in the inner bark, half at each end, at equal spacing around the circumference. The billets were then transported in polyethylene bags to the field for installation within 1 day.

Field sites were selected in the Atlantic Coastal Plain, Georgia Piedmont, and Southern Appalachian Mountains. Areas near Bolton, North Carolina, were selected as representative of conditions in the Coastal Plain. Because of the extremely high incidence of weevil damage in the latter region during recent years, three sites were selected to determine if the period of weevil development varied significantly under local conditions. These sites were (1) a sandy, well-drained ridge of longleaf pine, Pinus palustris Mill., (2) an open, poorly drained area, and (3) a typical swamp of pond pine, P. serotina Michx. An area of heavy clay soil near Athens, Georgia, was selected as representative of conditions in the Piedmont, and an area of clay soil at 640 m elevation in the Bent Creek Experimental Forest was selected as representative of conditions at lower elevations in the Southern Appalachians. Uncut sites were selected in order to avoid attraction and oviposition by weevils in the field.

The breeding of weevils in the roots of pines cut at various times was simulated by burying the billets. For each weevil species, 12 billets were buried at each site each month from May through August 1968. At each site, a trench about 40 cm wide, 180 cm long, and 20 cm deep was dug for each species, the 12 billets were laid side by side about 8 cm apart on the bottom of the trench, and the soil was then returned. Each billet was tagged with the installation date, and a wire was attached to aid in its recovery.

After each installation, the previously buried billets were uncovered and inspected for brood development. As soon as 10 developing insects were observed in three or more billets, the inspection was ended and the billets were reburied. The 10 observed insects served as an index of the stage of development of that particular brood. Because the onset of the pupal stage and the transformation from one stage to another commonly occurred between inspections, the date of transformation was estimated on the basis of observations of laboratory-reared insects. Although no billets were installed after August 1968, monthly inspections were continued through November 1969, by which time all of the weevils had either emerged or died.

RESULTS

Atlantic Coastal Plain.--The rates of development of both weevil species varied considerably at the three sites, but development was not consistently faster or slower at any one location. Whereas the first May brood to emerge was on the swamp site, later broods were slowest to develop there. In May and June, the billets in the swamp were above the water table. However, at subsequent inspections, the billets in the swamp were below the water table. Because there was no consistent pattern of development at a single location, the data from the three sites have been combined in the graphs for adult emergence in the Coastal Plain (fig. 1).

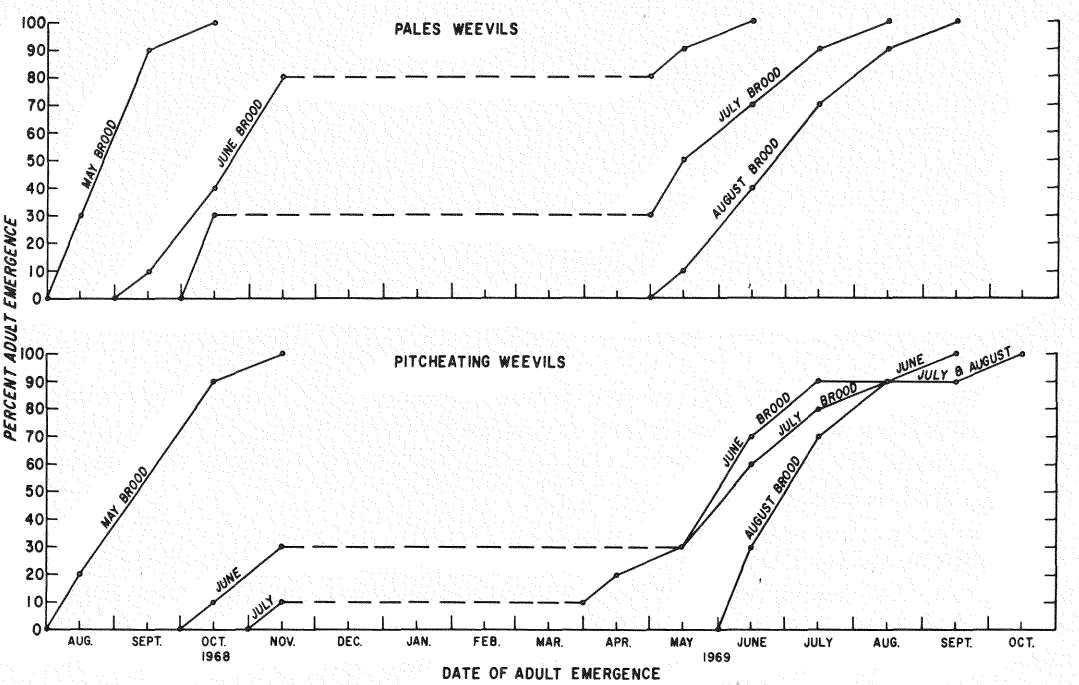

Figure 1.--Adult emergence of pales and pitcheating weevils in the Atlantic Coastal Plain from oviposition in May, June, July, and August 1968.

From May eggs, all of the pales and pitcheating weevils completed their development and emerged before December 1968. Developmental time of the May broods ranged from about 80 to 150 days for pales weevils and from about 90 to 180 days for pitcheating weevils.

From June and July eggs, all of the pales and pitcheating weevils had split periods of emergence, with some weevils completing their development in the fall of 1968 and the remainder completing their development the next year. Among the pales weevils, 80 percent of the June broods and 30 percent of the July broods completed their development and emerged by mid-November 1968; the remainder overwintered and emerged from May through August 1969. Among the pitcheating weevils, 30 percent of the June broods and 10 percent of the July broods emerged by mid-November 1968. The remainder of the June and July broods of pitcheating weevils overwintered as larvae and emerged from April through October 1969. Developmental time of the pales weevils from June and July eggs ranged from about 85 days for those with short-term development to about 437 days for those which overwintered. Developmental time of the pitcheating weevils from June and July eggs ranged from about 115 to 470 days.

Few weevils of the August broods of either species completed their development in the fall of 1968. On the ridge site, several pales weevils emerged in November 1968. The remainder of this brood, as well as all of the August broods of pales weevils on the other two sites, overwintered as larvae and completed their development from May through September 1969. None of the pitcheating weevils from August eggs completed development in 1968. All of these broods overwintered in the larval stage and emerged as adults from June through October 1969. Development time of the August broods of pales weevils ranged from about 86 to 408 days, whereas that of the pitcheating weevil ranged from about 290 to 477 days.

Georgia Piedmont.--From May eggs, the broods of both species completed development and emerged as adults principally in August and September 1968, with emergence terminating in October (fig. 2).

From June eggs, all of the pales weevils and about 60 percent of the pitcheating weevils emerged from September through November 1968. Those pitcheating weevils that overwintered emerged from April through June 1969.

There was a heavy mortality of July eggs of both species. From the larvae that completed development, 50 percent of the pales weevil adults emerged in November 1968. The remainder of the brood of both species overwintered, completed development, and emerged from May through September 1969.

From August eggs, the broods of both species all overwintered as larvae and completed their development the following year. The adults emerged from May through October 1969.

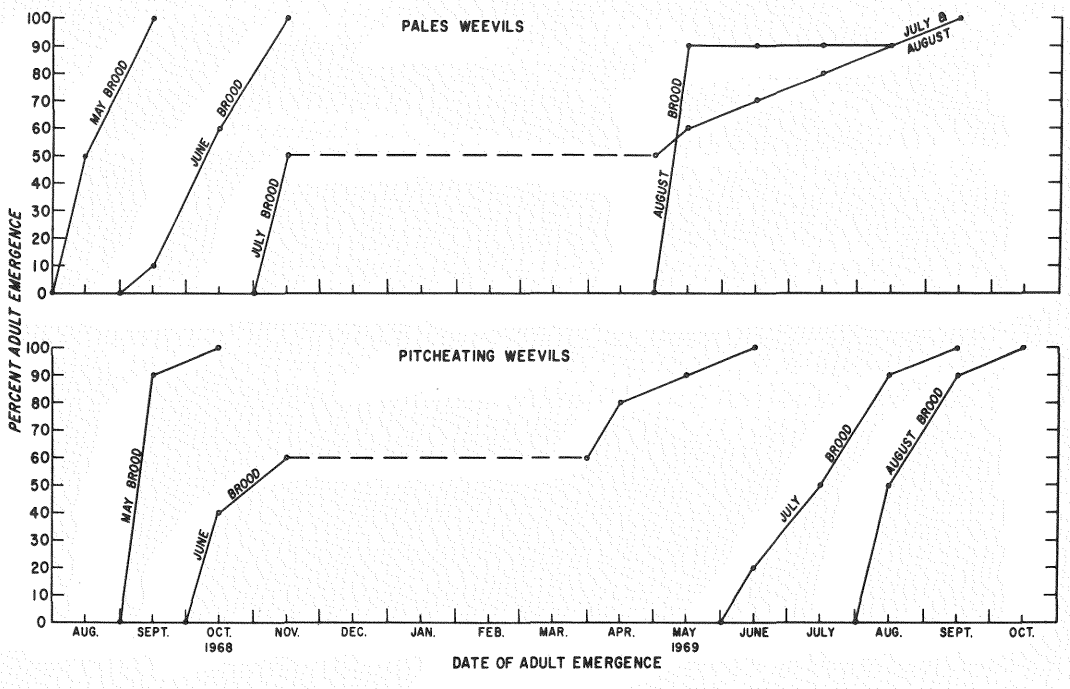

Figure 2.--Adult emergence of pales and pitcheating weevils in the Georgia Piedmont from oviposition in May, June, July, and August 1968.

Southern Appalachians.--For both species, all broods initiated in 1968 were still in the larval stage in April 1969. Development continued in the spring, and adult emergence began in May and extended through October 1969 (fig. 3). Minimum time for development was about 305 days for the pales weevil and about 335 days for the pitcheating weevil. Maximum time was about 365 days for the pales weevil and about 430 days for the pitcheating weevil.

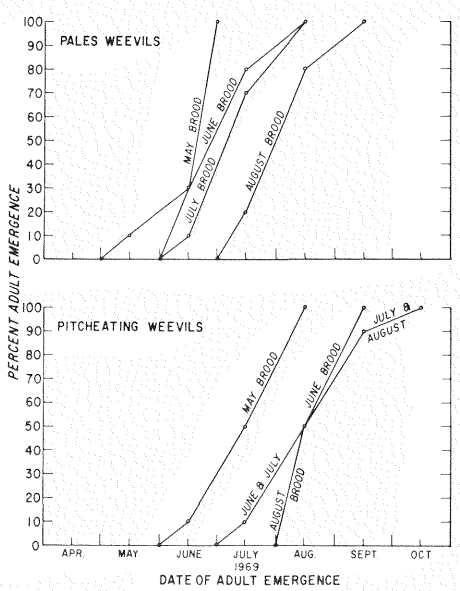

Figure 3.--Adult emergence of pales and pitcheating weevils in the Southern Appalachians from oviposition in May, June, July, and August 1968.

DISCUSSION

The data indicate that the time required for complete weevil development in the field can be as short as 3 months or as long as 14 months, depending on the date of oviposition and location. The factor probably responsible for this large variation is temperature. When temperatures are not sufficiently high for short-term development, the larvae overwinter, resume feeding in the spring, and complete development the following year.

Through limited testing and field observations, I have determined that adult weevils are attracted to and held in areas for feeding by recently cut pine trees and not by planted seedlings. All of the pales and pitcheating weevils that originated in May in both the Coastal Plain and Piedmont completed their development and emerged before December 1968. Because these weevils emerged before the tree planting season, which extends from December to March in the Southeast, they would pose no threat to newly planted trees.

In the Coastal Plain and Piedmont, June and July were transitional months because part of the broods originating in these months emerged in the fall and part, particularly those on the poorly drained areas, emerged during the following spring and summer. Although those weevils which emerged in the fall would not be a threat to seedlings planted during the following winter, some damage to such seedlings could be expected from the weevils which emerged in the spring and summer.

Nearly all of the August broods of both weevil species overwintered in the immature stage. Seedling damage would be expected to occur during the following summer by feeding of the adults after they emerged.

When timber harvesting of pine occurs after June in the Piedmont or Coastal Plain, or at any time during the summer or fall in the Southern Appalachians, the chances of weevil damage to seedlings planted during the winter become considerably greater because the newly planted seedlings may be fed upon by older weevils attracted into the cutting area and held there by the fresh stumps. Such seedlings may also be fed upon by new weevils which emerge in the year following cutting. From the data collected, it appears that heavy feeding on seedlings before April is done by overwintering adults which are attracted into cutover areas in the fall and that seedling damage from April through October is caused principally by new adults which develop in the immediate area.

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